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Short communication

Annotated List of the Korean Triphoridae (Gastropoda), with a New Record of *Mastonia rubra*

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ABSTRACT

The family Triphoridae Gray, 1847 is a group of marine microgastropods characterized by sinistral (left-coiled) shells except for the subfamily Metaciinae, which has dextral shell coiling. We report a new record of *Mastonia rubra* (Hinds, 1843) collected from the intertidal zone from Jeju Island, Korea and revise species list for Korean Triphoridae species. *Mastonia rubra* is distinguished from *Inforis fusiformis* (Kosuge, 1961) by the purple color of the first and second whorls of the teleoconch, whereas they are light colored and nearly white corresponding whorls in *I. fusiformis*. Including this new record, the Korean Triphoridae comprises 20 species from 15 genera.

Keywords: *Mastonia rubra*, Triphoridae, new record, annotated species list, Korea

INTRODUCTION

Triphoridae is a relatively specious, globally distributed marine gastropod family found in tropical and temperate seas. They are spongivorous microgastropods more than 1,000 extant species found from the intertidal zone down to nearly 1,000 m in depth. This group is usually characterized by tiny, elongate, sinistral (left-coiled) shells ranging from a few mm to 2 cm in shell height (Laseron, 1954, 1958; Kosuge, 1966; Marshall, 1983). However, species identification using shell morphology alone in this family is difficult, because intra- and inter-specific variability in shell external morphology is poorly defined (Albano et al., 2011; Albano and Bakker, 2016). To date, 19 triphorid species from 14 genera have been recorded in Korea (Lee and Min, 2002; Min et al., 2004; Kil and Lee, 2012; Kil et al., 2013). In this study, we report a new record of *Mastonia rubra* (Hinds, 1843) with a full morphological description and shell images and present a species list of the 20 Korean Triphoridae species.

In order to provide a summarized taxonomic list of Korean Triphoridae species, we re-examined triphorid species previously recorded in an illustrated guide, taxonomic checklist, and recently published papers (Lee and Min, 2002; Min et al., 2004; Kil and Lee, 2012; Kil et al., 2013). For the 19 species recorded from Korea, we compared the original descriptions of the species with their corresponding descriptions from Korean forms. Finally, we revised the taxonomic list of Korean Triphoridae species. The classification system of species list followed Bouchet and Rocroi (2005). In addition, one individual of *M. rubra* was collected in the intertidal zone of Jeju Island and identified as a new record from Korean waters. Shell morphology of the specimen was examined and compared with other Korean triphorid species using a stereoscopic microscope (Leica M205C, Wetzlar, Germany). The specimen examined was deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea (VQUMIV0000001636).

RESULTS

Systematic accounts of Korean Triphoridae

Phylum Mollusca Linnaeus, 1758
Class Gastropoda Cuvier, 1795
Order Sorbeoconcha Ponder & Lindberg, 1997
Family Triphoridae Gray, 1847

Genus *Aclophoropsis* B. A. Marshall, 1983

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[1*]**1. *Aclophoropsis mcmichaeli* (Kosuge, 1962)**

Cautor maculosus macmichaeli Kosuge, 1962: 85; Higo et al., 1999: 171; Lee & Min, 2002: 114; Min et al., 2004: 189, 191, fig. 462; Poppe, 2008: 724, Pl. 307, fig. 2; Kil et al., 2013: 259.

Aclophoropsis mcmichaeli Okutani, 2000: 317, Pl. 157, fig. 88.

Type locality. Ankyaba, Setouchi-machi, Amami Island, Japan.

Distribution. Fiji, Japan, Korea, Philippines.

Genus *Bouchetriphora* B. A. Marshall, 1983

[2*]**2. *Bouchetriphora* cf. *otsuensis* (Yokoyama, 1920)**

Triforis otsuensis Yokoyama, 1920: 69–70, Pl. 4, fig. 11; 1922: 74, fig. 16.

Triphora otsuensis Kosuge, 1966: 309, Pl. 1, fig. 12, text figs. 28–29, 35a, b, c; Higo et al., 1999: 168; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 458.

Bouchetriphora cf. *otsuensis* Okutani, 2000: 315, Pl. 156, fig. 74; Kil et al., 2013: 259.

Type locality. Yokosuka Zone, Upper Musashino of Kazusa, Japan. (Fossil).

Distribution. Japan, Korea, Philippines.

[3*]**3. *Bouchetriphora confusa* (Kosuge, 1963)**

Notosinister confuses Kosuge, 1963: 248–249, Pl. 17, fig. 34, text fig. 11.

Triphora confuse Higo et al., 1999: 169; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 460.

Bouchetriphora confuse Okutani, 2000: 315, Pl. 156, fig. 77; Kil et al., 2013: 259.

Type locality. Ankyaba, Setouchi-machi, Amami Island, Japan.

Distribution. Korea, Japan, Hawaii.

[4*]**4. *Bouchetriphora conspersa* (Smith, 1875)**

Trhiphoris conspersus Smith, 1875: 106; Pilsbry, 1895: 58.

Thiphoris purpuratus Pilsbry, 1895: 58.

Triphora conspersa Higo et al., 1999: 168.

Bouchetriphora conspersa Okutani, 2000: 315, Pl. 156, fig. 76.

Bouchetriphora consfera (sic) Kil and Lee, 2012: 275–276, fig. 1 (Misspelling).

Type locality. Shima peninsula, Mie Prefecture, Japan.

Distribution. Japan, Korea, Philippines, Taiwan.

Genus *Cautor* Finlay, 1926

[5*]**5. *Cautor granulatus* (Adams & Reeve, 1850)**

Triphoris granulatus Adams & Reeve, 1850: 46, Pl. 11, fig. 33A, B.

Triphora granulate Higo et al., 1999: 168; Min et al., 2004: 189, fig. 459.

Type locality. China Sea.

Distribution. Japan, Korea, Philippines, Taiwan, tropical IndoPacific.

Genus *Coriophora* Laseron, 1958

[6*]**6. *Coriophora fusca* (Dunker, 1860)**

Triforis fusca Dunker, 1860: 237; 1861: Pl. 2, fig. 22.

Mesophora fusca Marshall, 1983: 46, figs. 4I, 19I–K; Higo et al., 1999: 167; Okutani, 2000: 309, Pl. 153, fig. 37; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 452; Kil et al., 2013: 260.

Coriophora fusca: Özdikmen, 2013: 254.

Type locality. Dejima, Nagasaki, Japan.

Distribution. Australia, China, Indo-western Pacific, Japan, Korea.

Genus *Costatophora* Marshall, 1994

[7*]**7. *Costatophora iniqua* (Jousseaume, 1898)**

Mastonia iniqua Jousseaume, 1898: 75.

Triphora iniqua Habe & Kosuge, 1966: 104, Pl. 41, fig. 1; Higo et al., 1999: 167; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 453.

Tetraphora iniqua Marshall, 1983: 33, figs. 6F, 15D–F; Okutani, 2000: 307, Pl. 152, fig. 27; Poppe, 2008: 728, Pl. 309, fig. 7; Kil et al., 2013: 260.

Type locality. Djibouti, Red Sea.

Distribution. Australia, Indian Ocean, Japan, Korea, Philippines, Red Sea, Western Pacific.

Genus *Inella* Bayle, 1879

[8*]**8. *Inella sagamiensis* (Kuroda & Habe, 1971)**

Hypotriphora sagamiensis Kuroda & Habe, 1971: 266, Pl. 61, fig. 8; Higo et al., 1999: 164; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 448.

Inella sagamiensis Okutani, 2000: 303, Pl. 150, fig. 5; Kil et al., 2013: 259.

Korean name: [1*]쇠녹반점띠줄고둥, [2*]좁쌀띠줄고둥, [3*]흰색띠띠줄고둥, [4*]분홍염주송곳띠줄고둥, [5*]흰띠줄고둥, [6*]갈색두띠줄고둥, [7*]적색띠줄고둥, [8*]담갈색띠줄고둥

Type locality. Sagami Bay, Japan.
Distribution. Japan, Korea.

[1*]**9. *Inella japonica* Kuroda & Kosuge, 1963**

Inella japonica Kuroda & Kosuge, 1963: 265, Pl. 15, fig. 20, text fig. 1–2; Higo et al., 1999: 165; Okutani, 2000: 303, Pl. 150, fig. 9; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 449; Poppe, 2008: 724, Pl. 307, fig. 7; Kil et al., 2013: 259.

Type locality. Shirahama, Shimoda-machi, Izu Peninsula, Japan.
Distribution. Japan, Korea, Philippines, Taiwan.

Genus *Iniforis* Jousseaume, 1884

[2*]**10. *Iniforis fusiformis* (Kosuge, 1961)**

Triphora (*Iniforis*) *fusiformis* Kosuge, 1961: 314, Pl. 19, fig. 4, text fig. 1, 4.
Iniforis fusiformis Higo et al., 1999: 172; Okutani, 2000: 311, Pl. 154, fig. 47; Lee & Min, 2002: 114; Min et al., 2004: 191, fig. 463; Kil et al., 2013: 259.

Type locality. Ankyaba, Setouchi-machi, Amami Island, Japan.
Distribution. Japan, Korea, Taiwan, Thailand.

Genus *Latitriphora* B. A. Marshall, 1983

[3*]**11. *Latitriphora multigyrata* (Yokoyama, 1922)**

Triforis multigyrata Yokoyama, 1922: 74–75, Pl. 5, fig. 5.
Triphora multigyrata Higo et al., 1999: 168; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 457.
Latitriphora multigyrata Okutani, 2000: 307, Pl. 152, fig. 30; Kil et al., 2013: 259.

Type locality. Shito, Japan. (Fossil).
Distribution. Japan, Korea.

Genus *Litharium* Dall, 1924

[4*]**12. *Litharium kurodai* (Kosuge, 1962)**

Isotriphora kurodai Kosuge, 1962: 84–85, Pl. 5, fig. 5; Higo et al., 1999: 165–166; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 450.
Litharium kurodai Okutani, 2000: 315, Pl. 156, fig. 71; Kil et al., 2013: 260.
Type locality. Shirahama, Shimoda-machi, Izu Peninsula, Japan.
Distribution. Japan, Korea, Philippines.

Genus *Mastonia* Hinds, 1843

[5*]**13. *Mastonia cingulifera* (Pease, 1860)**

Triforis cingulifera Pease, 1860: 434.
Mastonia cingulifera Higo et al., 1999: 166–167; Lee & Min, 2002: 114; Min et al., 2004: 187, 189, fig. 451; Poppe, 2008: 726, Pl. 308. fig. 11; Kil et al., 2013: 260.

Type locality. Hawaii.
Distribution. Hawaii, Indo-Pacific, Japan, Korea, Philippines.

[6*]**14. *Mastonia millepunctata* (Kosuge, 1962)**

Notosinister millepunctata Kosuge, 1962: 83, Pl. 10, fig. 4; 1963: 243, Pl. 16, fig. 29.
Triphora millepunctata Kuroda & Habe, 1971: 268, Pl. 113, fig. 13; Higo et al., 1999: 168.
Mastonia millepunctata Okutani, 2000: 309, Pl. 153, fig. 45; Poppe, 2008: 726, Pl. 308, fig. 10; Kil et al., 2013: 260, fig. 1A, B.

Type locality. Ankyaba, Setouchi-machi, Amami Island, Japan.
Distribution. Japan, Korea, Philippines.

[7*]**15. *Mastonia rubra* (Hinds, 1843)**

[8*]**16. *Mastonia thetis* (Hedly, 1899)**

Triforis thetis Hedley, 1899: 445.
Triphora thetis Higo et al., 1999: 168; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 456; Kil et al., 2013: 260.
Mastonia thetis Okutani, 2000: 311, Pl. 153, fig. 46.

Type locality. Tuvalu, Polynesia.
Distribution. Japan, Korea, Philippines, tropical Pacific.

Genus *Monophorus* Grillo, 1877

[9*]**17. *Monophorus testaceus* (Kosuge, 1963)**

Notosinister testaceus Kosuge, 1963: 245, Pl. 16, fig. 21, text figs. 1, 2.
Triphora testacea Higo et al., 1999: 169.
Triphora undata Min et al., 2004: 189, fig. 462.
Monophorus testacea Okutani, 2000: 305, Pl. 151, fig. 17; Kil et al., 2013: 260, fig. 1C, D.

Type locality. Ankyaba, Amani Island, Japan.
Distribution. China, Japan, Korea, Taiwan, Philippines.

Korean name: [1*]흐린반점띠줄고둥, [2*]뾰족띠줄고둥, [3*]흰누렁띠줄고둥, [4*]농갈색띠줄고둥, [5*]이색고리띠줄고둥, [6*]빨강꼭지두줄좁쌀띠줄고둥, [7*]보라병띠줄고둥(신칭), [8*]두줄좁쌀띠줄고둥, [9*]흐린띠좁쌀띠줄고둥

Genus *Nototriphora* Marshall, 1983

[1*]**18. *Nototriphora alba* (Kosuge, 1961)**

Triphora alba Kosuge, 1961: 314–315, Pl. 19, fig. 2, text figs. 3, 6.

Iniforis alba Higo et al., 1999: 167; Lee & Min, 2002: 114; Min et al., 2004: 191, fig. 464.

Nototriphora alba Okutani, 2000: 317, Pl. 157, fig. 83; Kil et al., 2013: 260.

Type locality. Ankyaba, Amani Island, Japan.
Distribution. Japan, Korea, Philippines.

Genus *Obesula* Jousseaume, 1884

[2*]**19. *Obesula turricula* (Hervier, 1898)**

Triforis (*Mastonia*) *turricula* Hervier, 1898: 305, Pl. 17, fig. 9.

Notosinister turriculus Kosuge, 1963: 242, Pl. 15, fig. 11.

Triphora turricula Higo et al., 1999: 168.

Obesula turricula Okutani, 2000: 315, Pl. 156, fig. 78; Kil et al., 2013: 260–261, fig. 1E, F.

Type locality. Lifou, Loyalty Island, New Caledonia.
Distribution. Japan, Korea, Philippines, tropical Pacific.

Genus *Viriola* Jousseaume, 1884

[3*]**20. *Viriola tricincta* (Dunker, 1882)**

Trigoris tricincta Dunker, 1882: 109.

Viriola tricincta Higo et al., 1999: 163; Okutani, 2000: 313, Pl. 155, fig. 58; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 447; Poppe, 2008: 730, Pl. 310, fig. 9; Kil et al., 2013: 260.

Type locality. Nagasaki, Japan.
Distribution. Japan, Korea, Philippines, Taiwan.

Description of species

[4*]Phylum Mollusca Linnaeus, 1758

[5*]Class Gastropoda Cuvier, 1795

[6*]Order Sorbeoconcha Ponder & Lindberg, 1997

[7*]Family Triphoridae Gray, 1847

[8*]Genus *Mastonia* Hinds, 1843

[9*]***Mastonia rubra* (Hinds, 1843) (Fig. 1)**

Triphoris ruber Hinds, 1843: 19.

Mastonia rubra Kosuge, 1966: 306, Pl. 1, fig. 3; Okutani, 2000: 309, Pl. 153, fig. 39.

Type locality. New Ireland, Papua New Guinea.
Material examined. 1 individual, Korea, Jeju Island, Seogwipo-si, Andeok-myeon, Sagye-ri, 33°13′40″N, 126°18′32″E, intertidal zone, 23 Apr 2017.

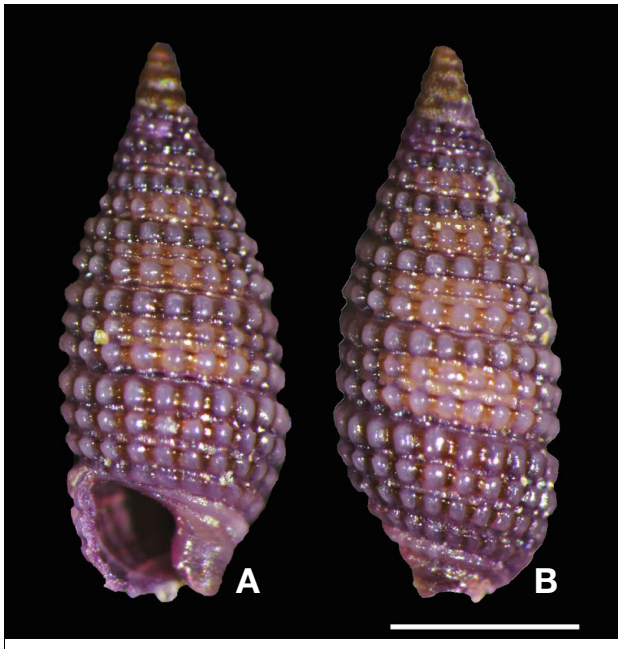

Fig. 1. *Mastonia rubra* (Hinds, 1843). A, Ventral view; B, Dorsal view. Scale bar = 1 mm.

Measurements. Shell height 2.5 mm; Shell width 1.2 mm.
Description. Shell small and purple in color, more or less inflated spindle shaped, solid, sinistral. Suture shallow, but each whorl distinct. Whorls consist of 3 protoconch whorls and 6 teleoconch whorls. Protoconchs multispiral, cylindrical, reddish brown in color; whorls with spiral cords crossed by numerous thin axial ribs. Protoconch and teleoconch transition quite clearly delimited. Teleoconch slightly stout, sculptured, with 3 rows of nodules, but body whorl sculptured with 4 rows of nodules, median row weak. Nodules light purple and round. Aperture round-oval in shape. Posterior canal deep and circular, folded and opened.
Habitat. Under rocks in the intertidal zone.
Distribution. Indo-West Pacific, Japan, Korea.

DISCUSSION

Species identification of Triphoridae species is difficult based upon shell morphology alone, as members of this family have a very small shell body, with a similar pattern of nodular spiral cords. *Mastonia rubra* is similar to *Inforis fusiformis* (Kosuge, 1961) in size and external shape, but differs in the

Korean name: [1*]흰바탕띠줄고둥, [2*]갈색반점띠줄고둥, [3*]띠줄고둥, [4*]연체동물문, [5*]복족강, [6*]흡강목, [7*]띠줄고둥과, [8*]병띠줄고둥속, [9*]보라병띠줄고둥(신칭)

color of the initial teleoconch whorls: the first and second whorls of the teleoconch of *I. fusiformis* are light colored or almost white, whereas in *M. rubra* they are the same color as the rest of the teleoconch. Furthermore, *M. rubra* is characterized by its purple shell color and weak middle row.

In this study, we provided an annotated list of 20 Korean triphorid species from 15 genera, including *M. rubra* which is a new record in Korean waters. In addition, the report of *Triphora undata* (Kosuge, 1962) by Min et al. (2004) contains the same specimen under the same Korean name as previously recorded *Monophorus testaceus* (Kosuge, 1963) published in Kil et al. (2013). After careful examination of the key characters of its morphology from these two previous records, we came to a conclusion that *Triphora undata* (Kosuge, 1962) *sensu* Min et al., 2004 is the same species as *M. testaceus* of Kil et al. (2013).

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